

SLM320240A Series GRAPHIC MONO TFT LCD MODULE USER MANUAL

Please click the following image to buy the sample



Shenzhen Surenoo Technology Co.,Ltd.

www.surennoo.com

Skype: Surenoo365

Reference Controller Datasheet

Graphic LCD Selection Guide

UCi8835

CONTENTS

1. CHARACTERISTICS
2. Pin Description(J1=J1_1)
3. Pin Description(J2=J2_2)
4. Pin Description(J1_3)
5. Electrical Characteristics
6. Controller Information(for UCi8835)
7. Font Characteristic
8. Additional instruction Information(Characteristics of the I2C-bus)
9. Reliability Test Conditions
10. INSPECTION CRITERION
11. HANDLING PRECAUTIONS
12. PRECAUTION FOR USE
13. PACKING SPECIFICATION

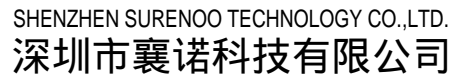
DATE	DESCRIPTION
2018-11-30	First release



1. CHARACTERISTICS

1.1 DISPLAY CHARACTERISTICS

Item	Contents	Note
Resolution(H*V)	320×240 Dots	
Colors	Mono TFT display	
Font & Background Color	Font color and background color can be customized as needed	Can be freely divided into ten display areas Any window
Active area (L*W)	115.2 mm(L)×86.4 mm(W)	
Viewing area (L*W)	117.56 mm(L)×88.62 mm(W)	
Module size (L*W*H)	160 mm(L)×109 mm(W)x111.4(H)	
Back light type	LED	
B/L brightness	400nit	
Touch Panel Type	Without	
Controller IC	UCi8835	
Viewing Direction	6 o'clock	
Contrast Ratio	300(typ.)	



2. Pin Description(J1=J1_1):

Pin No.	Symbol	External Connection	Function Description																																								
1	VSS	Power Supply	GND																																								
2	VDD	Power Supply	Power supply																																								
3	NC	/	No connection																																								
4	/WR	MPU	(8080:) Write Control or (6800:) Read/Write Control.																																								
5	/RD	MPU	Multifunction pin 1)(8080)Read Control or (6800:) Enable. For UCi6963 2) I2C interface: as SCL pin (Internal pull-up resistor)																																								
6	/CS	MPU	Active LOW Chip Select signal																																								
7	A0(=RS=C/D)	MPU	Multifunction pin 1)for UCi8835 8080 Family Interface: <table border="1"> <thead> <tr> <th>A0</th><th>RD</th><th>WR</th><th>Function</th></tr> </thead> <tbody> <tr> <td>0</td><td>0</td><td>1</td><td>Status flag read</td></tr> <tr> <td>1</td><td>0</td><td>1</td><td>Display data and cursor address read</td></tr> <tr> <td>0</td><td>1</td><td>0</td><td>Display data and parameter write</td></tr> <tr> <td>1</td><td>1</td><td>0</td><td>Command write</td></tr> </tbody> </table> 6800 Family Interface: <table border="1"> <thead> <tr> <th>A0</th><th>R/W</th><th>E</th><th>Function</th></tr> </thead> <tbody> <tr> <td>0</td><td>1</td><td>1</td><td>Status flag read</td></tr> <tr> <td>1</td><td>1</td><td>1</td><td>Display data and cursor address read</td></tr> <tr> <td>0</td><td>0</td><td>1</td><td>Display data and parameter write</td></tr> <tr> <td>1</td><td>0</td><td>1</td><td>Command write</td></tr> </tbody> </table> 2) I2C interface: as SDA pin (Internal pull-up resistor)	A0	RD	WR	Function	0	0	1	Status flag read	1	0	1	Display data and cursor address read	0	1	0	Display data and parameter write	1	1	0	Command write	A0	R/W	E	Function	0	1	1	Status flag read	1	1	1	Display data and cursor address read	0	0	1	Display data and parameter write	1	0	1	Command write
A0	RD	WR	Function																																								
0	0	1	Status flag read																																								
1	0	1	Display data and cursor address read																																								
0	1	0	Display data and parameter write																																								
1	1	0	Command write																																								
A0	R/W	E	Function																																								
0	1	1	Status flag read																																								
1	1	1	Display data and cursor address read																																								
0	0	1	Display data and parameter write																																								
1	0	1	Command write																																								
8	/RST	MPU	Active LOW Reset signal																																								
9~16	DB0~DB7	MPU	8-bit bidirectional data bus																																								
17	NC/LED PWM	NC/MPU	Backlight enable signal, 1=On, 0=Off																																								
18	NC	/	No connection																																								
19	NC/LED PWM	NC/MPU	Backlight enable signal, 1=On, 0=Off																																								
20	NC	/	No connection																																								

3. Pin Description(J2=J2_2):

Pin No.	Symbol	External Connection	Function Description
1	D0	MPU	Data for LCD Driver
2	D1	MPU	Data for LCD Driver
3	D2	MPU	Data for LCD Driver
4	D3	MPU	Data for LCD Driver
5	DISP	MPU	Display on/off signal
6	FLM	MPU	Fram signal
7	M	MPU	AC drive signal
8	LP	MPU	Latch Pulse
9	CP	MPU	Data shift clock
10	VDD	Power Supply	Power supply
11	VSS	Power Supply	GND
12	NC	/	No connection
13	NC	/	No connection
14	FG		Frame ground

4. Pin Description(J1_3):

Pin No.	Symbol	External Connection	Function Description																																								
1	VSS	Power Supply	GND																																								
2	VDD	Power Supply	Power supply																																								
3	NC	/	No connection																																								
4	A0(=RS=C/D)	MPU	<p>Multifunction pin 1)for UCi8835</p> <p>8080 Family Interface:</p> <table border="1"> <thead> <tr> <th>A0</th><th>RD</th><th>WR</th><th>Function</th></tr> </thead> <tbody> <tr> <td>0</td><td>0</td><td>1</td><td>Status flag read</td></tr> <tr> <td>1</td><td>0</td><td>1</td><td>Display data and cursor address read</td></tr> <tr> <td>0</td><td>1</td><td>0</td><td>Display data and parameter write</td></tr> <tr> <td>1</td><td>1</td><td>0</td><td>Command write</td></tr> </tbody> </table> <p>6800 Family Interface:</p> <table border="1"> <thead> <tr> <th>A0</th><th>R/W</th><th>E</th><th>Function</th></tr> </thead> <tbody> <tr> <td>0</td><td>1</td><td>1</td><td>Status flag read</td></tr> <tr> <td>1</td><td>1</td><td>1</td><td>Display data and cursor address read</td></tr> <tr> <td>0</td><td>0</td><td>1</td><td>Display data and parameter write</td></tr> <tr> <td>1</td><td>0</td><td>1</td><td>Command write</td></tr> </tbody> </table> <p>2) I2C interface: as SDA pin (Internal pull-up resistor)</p>	A0	RD	WR	Function	0	0	1	Status flag read	1	0	1	Display data and cursor address read	0	1	0	Display data and parameter write	1	1	0	Command write	A0	R/W	E	Function	0	1	1	Status flag read	1	1	1	Display data and cursor address read	0	0	1	Display data and parameter write	1	0	1	Command write
A0	RD	WR	Function																																								
0	0	1	Status flag read																																								
1	0	1	Display data and cursor address read																																								
0	1	0	Display data and parameter write																																								
1	1	0	Command write																																								
A0	R/W	E	Function																																								
0	1	1	Status flag read																																								
1	1	1	Display data and cursor address read																																								
0	0	1	Display data and parameter write																																								
1	0	1	Command write																																								
5	/WR	MPU	(8080:) Write Control or (6800:) Read/Write Control.																																								
6	/RD	MPU	<p>Multifunction pin 1)(8080)Read Control or (6800:) Enable. For UCi6963 2) I2C interface: as SCL pin (Internal pull-up resistor)</p>																																								
7~14	DB0~DB7	MPU	8-bit bidirectional data bus																																								
15	/CS	MPU	Active LOW Chip Select signal																																								
16	/RST	MPU	Active LOW Reset signal																																								
17	NC	/	No connection																																								
18	SEL1	MPU	<p>MCU Interface Select. The UCi8835 series supports both 8080 family processors (such as the 8085 and Z80®) and 6800 family processors (such as the 6802 and 6809). SEL1=0=8080 family ; SEL1=1=6800 family ;</p>																																								
19	FGND	Power Supply	GND																																								
20	NC	/	No connection																																								

5. Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	Top	Absolute Max	-20	-	+70	°C
Storage Temperature Range	Tst	Absolute Max	-30	-	+80	°C
Supply Voltage	VDD		3.3	5.0	5.5	V
Input High Voltage	VIH		0.8*VDD	-	VDD	V
Input Low Voltage	VIL		0	-	0.2*VDD	V
Supply Current	IVCI		-	350	-	mA
Power Consumption	PLCM		-	1750	-	mW

6. Controller Information(for UC18835)

6.1 CONTROL AND DISPLAY INSTRUCTION

COMMAND TABLE

C/D: 1: Command / 0: Data

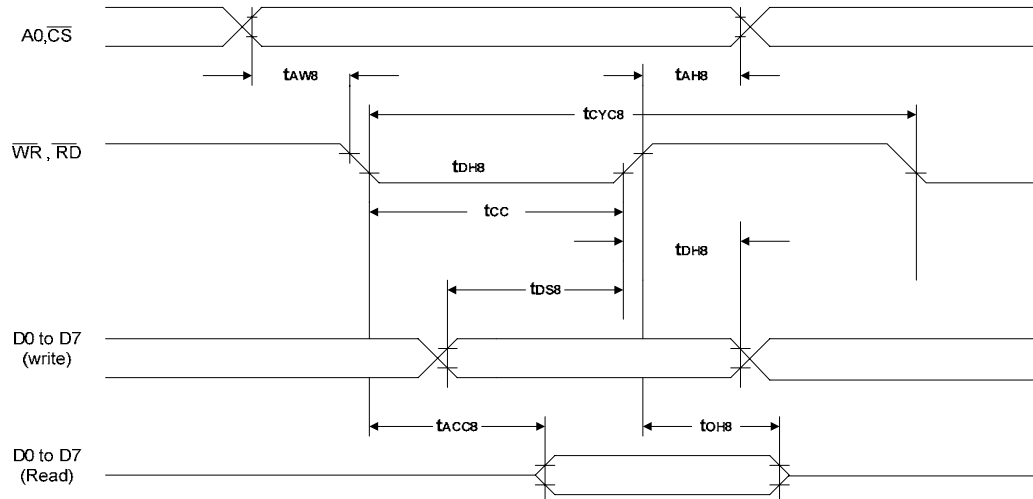
W/R: 0: Write Cycle / 1: Read Cycle

D7-D0: -: Don't Care

No.	Command	C/D	W/R	D7	D6	D5	D4	D3	D2	D1	D0	Action	Value
1	System Set	1	0	0	1	0	0	0	0	0	0	Initialize device and display	40h
		0	0	0	0	IV	1	W/S	M2	M1	M0		
		0	0	WF	0	0	0	0	FY2	FY1	FY0		
		0	0	0	0	0	0	FY3	FY2	FY1	FY0		
		0	0	C/R[7:0]									
		0	0	TC/R[7:0]									
		0	0	L/F[7:0]									
		0	0	APL[7:0]									
		0	0	C/R[7:0]									
2	MWRITE	1	0	0	1	0	0	0	0	1	0	Write to display memory	42h
		0	0	1 ... N								Write Display data byte (n times)	
3	MREAD	1	0	0	1	0	0	0	0	1	1	Read from display memory	43h
		0	0	1 ... N								Read Display data byte (n times)	
4	Scroll	1	0	0	1	0	0	0	1	0	0	Initialize device and display	44h
		0	0	SAD1[7:0]								SAD1L	
		0	0	SAD1[15:8]								SAD1H	
		0	0	SL1[7:0]								SL1	0~255
		0	0	SAD2[7:0]								SAD2L	
		0	0	SAD2[15:8]								SAD2H	
		0	0	SL2[7:0]								SL2	0~255
		0	0	SAD3[7:0]								SAD3L	
		0	0	SAD3[15:8]								SAD3H	
		0	0	SAD4[7:0]								SAD4L	
		0	0	SAD4[15:8]								SAD4H	
5	CSRW	1	0	0	1	0	0	0	1	1	0	Set cursor address	46h
		0	0	CSR[7:0]								Write CSRL	
		0	0	CSR[15:8]								Write CSRH	
6	CSRR	1	0	0	1	0	0	0	1	1	1	Set cursor address	47h
		0	1	CSR[7:0]								Read CSRL	
		0	1	CSR[15:8]								Read CSRH	
7	CSRDIR	1	0	0	1	0	0	1	1	CD1	CD0	Set direction of cursor move	4C-4Fh
8	Sleep IN	1	0	0	1	0	1	0	0	1	1	Enter standby mode	53h
9	Display ON/OFF	1	0	0	1	0	1	1	0	0	D	Enable/Disable display	58/59h
		0	0	FP5	FP4	FP3	FP2	FP1	FP0	FC1	FC0		
10	HDOT SCR	1	0	0	1	0	1	1	0	1	0	Set Horizontak Scroll position	5Ah
		0	0	0	0	0	0	0	D2	D1	D0	D[2:0]	0-7
11	OVLAY	1	0	0	1	0	1	1	0	1	1	Set display overlay format	5Bh
		0	0	0	0	0	OV	DM2	DM1	MX1	MX0		
12	CGRAM Address	1	0	0	1	0	1	1	1	0	0	Set Start address of character generator RAM	5Ch
		0	0	SAG[7:0]								SAGL	

6.2 Interface Timing Diagram and Timing Characteristics

6.2.1 8080 Family Interface Timing



Ta = -20 to 75°C

Signal	Symbol	Parameter	V _{DD} = 4.5 to 5.5V		V _{DD} = 2.7 to 4.5V		Unit	Condition
			Min.	Max.	Min.	Max.		
A0, CS	t_{AH8}	Address hold time	10	—	10	—	ns	CL = 100pF
	t_{AW8}	Address setup time	0	—	0	—	ns	
WR, RD	t_{CYC8}	System cycle time	note.	—	note.	—	ns	
	t_{CC}	Strobe pulse width	120	—	150	—	ns	
D0 to D7	t_{DS8}	Data setup time	120	—	120	—	ns	
	t_{DH8}	Data hold time	5	—	5	—	ns	
	t_{ACC8}	RD access time	—	50	—	80	ns	
	t_{OH8}	Output disable time	10	50	10	55	ns	

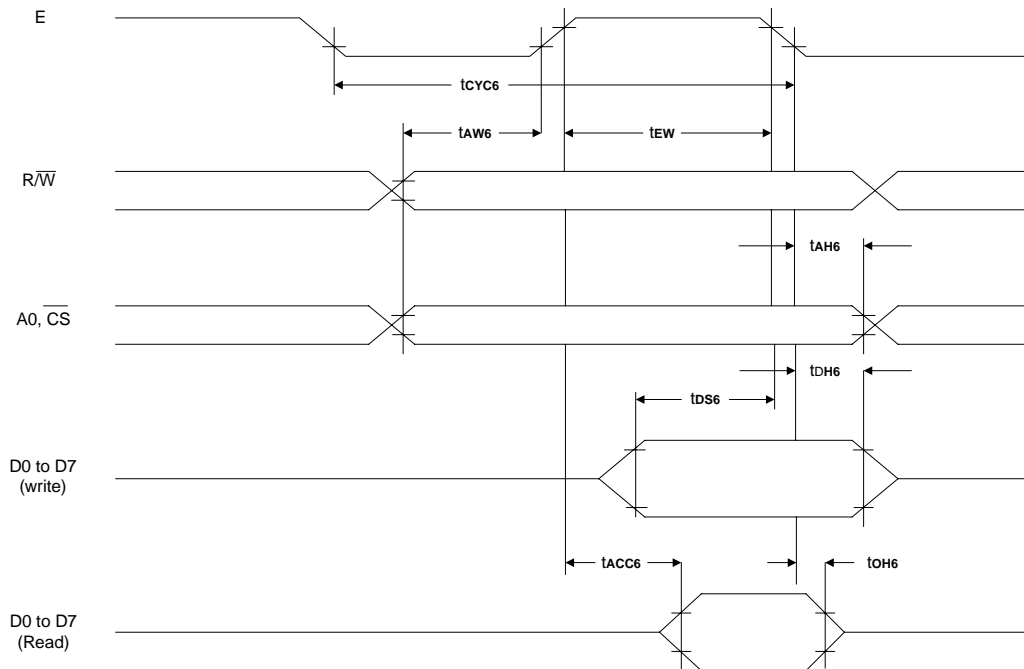
Note: For memory control and system control commands:

$$t_{CYC8} = 2t_C + t_{CC} + t_{CEA} + 75 > t_{ACV} + 245$$

For all other commands:

$$t_{CYC8} = 4t_C + t_{CC} + 30$$

6.2.2 6800 Family Interface Timing



$T_a = -20 \text{ to } 75^\circ\text{C}$

Signal	Symbol	Parameter	$V_{DD} = 4.5 \text{ to } 5.5\text{V}$		$V_{DD} = 2.7 \text{ to } 4.5\text{V}$		Unit	Condition
			Min.	Max.	Min.	Max.		
A0, \overline{CS} , R/(W)	t_{CYC6}	System cycle time	note.	—	note.	—	ns	CL = 100 pF
	t_{AW6}	Address setup time	0	—	10	—	ns	
	t_{AH6}	Address hold time	0	—	0	—	ns	
D0 to D7	t_{DS6}	Data setup time	100	—	120	—	ns	
	t_{DH6}	Data hold time	0	—	0	—	ns	
	t_{OH6}	Output disable time	10	50	10	75	ns	
	t_{ACC6}	Access time	—	85	—	130	ns	
E	t_{EW}	Enable pulse width	120	—	150	—	ns	

Note: For memory control and system control commands:

$$t_{CYC6} = 2t_C + t_{EW} + t_{CEA} + 75 > t_{ACV} + 245$$

For all other commands:

$$t_{CYC6} = 4t_C + t_{EW} + 30$$

7. Font Characteristic

		Character code bits 0 to 3															
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Character code bit 4 to 7	2																
	3																
	4																
	5																
	6																
	7																
	A																
	B																
	C																
	D																
	1																

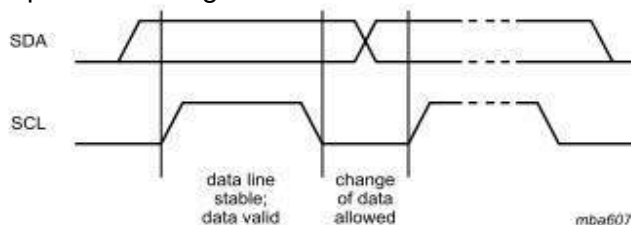
Figure 8-14: On-chip Character Set

Note: The shaded positions indicate characters that have the whole 6 x 8 bitmap blackened.

8. Additional instruction Information(Characteristics of the I2C-bus)

8.1 Bit transfer

One data bit is transferred during each clock pulse. The data on the SDA line must remain stable during the HIGH period of the clock pulse as changes in the data line at this time will be interpreted as a control signal



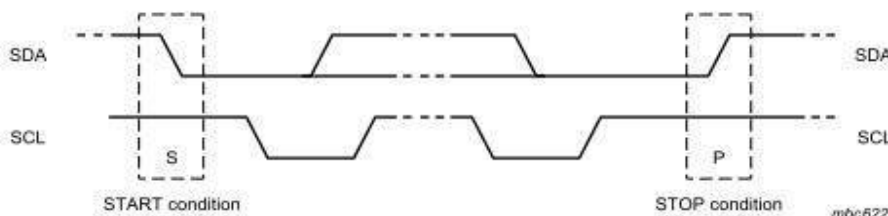
8.2 START and STOP conditions

Both data and clock lines remain HIGH when the bus is not busy.

A HIGH-to-LOW transition of the data line while the clock is HIGH is defined as the START condition - S.

A LOW-to-HIGH transition of the data line while the clock is HIGH is defined as the STOP condition - P.

The START and STOP conditions are illustrated following.

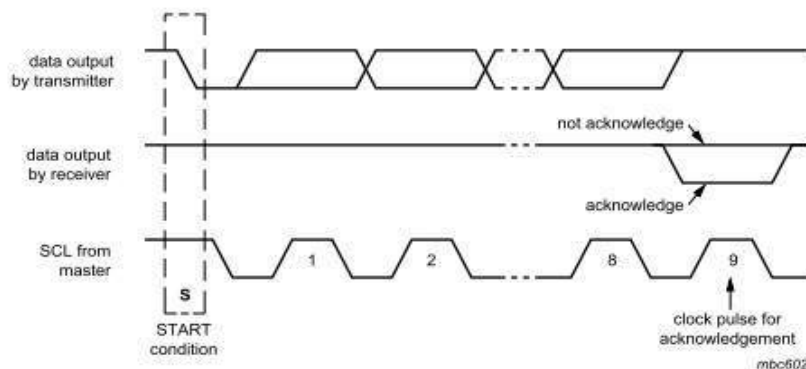


8.3 Acknowledge

The number of data bytes transferred between the START and STOP conditions from transmitter to receiver is unlimited. Each byte of eight bits is followed by an acknowledge cycle.

- A slave receiver, which is addressed, must generate an acknowledge after the reception of each byte
- A master receiver must generate an acknowledge after the reception of each byte that has been clocked out of the slave transmitter
- The device that acknowledges must pull-down the SDA line during the acknowledge clock pulse, so that the SDA line is stable LOW during the HIGH period of the acknowledge related clock pulse (set-up and hold times must be taken into consideration)
- A master receiver must signal an end of data to the transmitter by not generating an acknowledge on the last byte that has been clocked out of the slave. In this event, the transmitter must leave the data line HIGH to enable the master to generate a STOP condition

Acknowledgement on the I2C-bus is illustrated following.



8.4 I2C-bus protocol

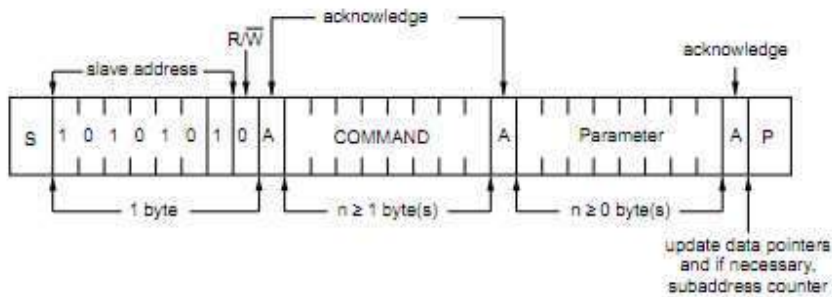
The I2C-bus slave addresses (1010 101) are used to address the NP6335. The entire I2C-bus slave address byte is shown following.



Bit	Slave address							0
	7	6	5	4	3	2	1	
	MSB							LSB
	1	0	1	0	1	0	1	R/W

The NP6335 is a **write-only** device and will not respond to a read access, therefore bit 0 should always be logic 0.

The I2C-bus protocol is shown following. The sequence is initiated with a START condition (S) from the I2C-bus master which is followed by slave addresses available. After an acknowledgement, one command byte follow that define the status of addressed NP6335, and then, one or more parameter data bytes may follow. After the last parameter byte, the I2C-bus master asserts a STOP condition (P). Alternately a START may be asserted to restart an I2C-bus access.



8.5 Instruction Table

Command		Operation Code								Note
Bit		7	6	5	4	3	2	1	0	
C	Main display area set	1	0	0	0	0	0	0	1	0x81
P	Xstart_H(upper left corner)	Xs7	Xs6	Xs5	Xs4	Xs3	Xs2	Xs1	Xs0	0~1
P	Xstart_L(upper left corner)	Xs7	Xs6	Xs5	Xs4	Xs3	Xs2	Xs1	Xs0	0~239
P	Ystart(upper left corner)	Ys7	Ys6	Ys5	Ys4	Ys3	Ys2	Ys1	Ys0	0~127
P	Xend(bottom right corner)	Xe7	Xe6	Xe5	Xe4	Xe3	Xe2	Xe1	Xe0	0~239
P	Yend(bottom right corner)	Ye7	Ye6	Ye5	Ye4	Ye3	Ye2	Ye1	Ye0	0~127
P	character Color R	Cr7	Cr6	Cr5	Cr4	Cr3	Cr2	Cr1	Cr0	0~255
P	character Color G	Cg7	Cg6	Cg5	Cg4	Cg3	Cg2	Cg1	Cg0	0~255
P	character Color B	Cb7	Cb6	Cb5	Cb4	Cb3	Cb2	Cb1	Cb0	0~255
P	background Color R	Br7	Br6	Br5	Br4	Br3	Br2	Br1	Br0	0~255
P	background Color G	Bg7	Bg6	Bg5	Bg4	Bg3	Bg2	Bg1	Bg0	0~255
P	background Color B	Bb7	Bb6	Bb5	Bb4	Bb3	Bb2	Bb1	Bb0	0~255

Command		Operation Code								Note
Bit		7	6	5	4	3	2	1	0	
C	Second~tenth display area set	1	0	0	0	0	0	0	1	0x82~0x8A
P	Xstart_H(upper left corner)	Xs7	Xs6	Xs5	Xs4	Xs3	Xs2	Xs1	Xs0	0~1
P	Xstart_L(upper left corner)	Xs7	Xs6	Xs5	Xs4	Xs3	Xs2	Xs1	Xs0	0~239
P	Ystart(upper left corner)	Ys7	Ys6	Ys5	Ys4	Ys3	Ys2	Ys1	Ys0	0~127
P	Xend(bottom right corner)	Xe7	Xe6	Xe5	Xe4	Xe3	Xe2	Xe1	Xe0	0~239
P	Yend(bottom right corner)	Ye7	Ye6	Ye5	Ye4	Ye3	Ye2	Ye1	Ye0	0~127
P	character Color R	Cr7	Cr6	Cr5	Cr4	Cr3	Cr2	Cr1	Cr0	0~255
P	character Color G	Cg7	Cg6	Cg5	Cg4	Cg3	Cg2	Cg1	Cg0	0~255
P	character Color B	Cb7	Cb6	Cb5	Cb4	Cb3	Cb2	Cb1	Cb0	0~255
P	background Color R	Br7	Br6	Br5	Br4	Br3	Br2	Br1	Br0	0~255
P	background Color G	Bg7	Bg6	Bg5	Bg4	Bg3	Bg2	Bg1	Bg0	0~255
P	background Color B	Bb7	Bb6	Bb5	Bb4	Bb3	Bb2	Bb1	Bb0	0~255

8.6 Code Example

```
//=====新增函数部分(Newly added function)=====//
//新增指令I2C通讯的相关函数(The new command is I2C communication,Newly added function declaration)
void I2C_Start(void);
void I2C_Stop(void);
unsigned char I2C_Wait_Ack(void);
unsigned char I2C_Send_Byte(unsigned char txd);
void Set_Area_Color( unsigned int *par);
//产生I2c起始信号(Generate I2C start bit)
void I2C_Start(void)
{
    CD_i2cSDA=1;
    Delay_Xus(1);
    RD_i2cSCL=1;
    Delay_Xus(1);
    CD_i2cSDA=0;//START:when CLK is high,DATA change form high to low
    Delay_Xus(1);
    RD_i2cSCL=0;
}
//产生I2c停止信号(Generate I2C stop bit)
void I2C_Stop(void)
{
    RD_i2cSCL=0;
    Delay_Xus(1);
    CD_i2cSDA=0;//STOP:when CLK is high,DATA change form low to high
    Delay_Xus(1);
    RD_i2cSCL=1;
    Delay_Xus(1);
    CD_i2cSDA=1;
    Delay_Xus(1);
}
//等待应答信号到来(I2C Wait Ack signal)
//返回值: 1, 接收应答失败(return :1=received ACK OK)
//        0, 接收应答成功(return :1=received ACK NG)
unsigned char I2C_Wait_Ack(void)
{
    unsigned char ucErrTime=0;
    CD_i2cSDA=1;Delay_Xus(1);
    RD_i2cSCL=1;Delay_Xus(1);
    while(CD_i2cSDA)
    {
        ucErrTime++;
        if(ucErrTime>250)
        {
            I2C_Stop();
            return 1;
        }
    }
    RD_i2cSCL = 0;
    return 0;
}
```



//I2c发送一个字节(Send one byte)

//返回值: 1, 接收应答失败(return :1=received ACK OK)

// 0, 接收应答成功(return :1=received ACK NG)

unsigned char I2C_Send_Byte(unsigned char txd)

```
{
    unsigned char t;
    RD_i2cSCL=0;
    for(t=0;t<8;t++)
    {
        CD_i2cSDA=(txd&0x80)>>7;
        txd<<=1;
        Delay_Xus(1);
        RD_i2cSCL=1;
        Delay_Xus(1);
        RD_i2cSCL=0;
        Delay_Xus(1);
    }
    return I2C_Wait_Ack();
}
//=====//
//-----新增加的指令-----//
//设置区域坐标颜色(Set the coordinate and color of the Multifunction)
//一次发送12个字节(Send 12 bytes at a time)
//command 0X81,set display Multifunction1,arae1 must be set full screen(0/0,239/127) as background
//command 0X82,set display Multifunction2
//command 0X83,set display Multifunction3
//=====//
void Set_Area_Color( unsigned int *par)
{
    //区域坐标颜色设置指令格式详细如下(one command details are as follows)
    I2C_Start();
    I2C_Send_Byte((unsigned char)par[0]); //device address
    I2C_Send_Byte((unsigned char)par[1]); //command 0X81,set display Multifunction1,arae1 must be set full
screen(0/0,239/127) as background
    I2C_Send_Byte((unsigned char)(par[2]>>8)); //set the coordinate of the upper left corner point, Xstart_H
    I2C_Send_Byte((unsigned char)par[2]); //set the coordinate of the upper left corner point, Xstart_L
    I2C_Send_Byte((unsigned char)par[3]); //set the coordinate of the upper left corner point, Ystart
    I2C_Send_Byte((unsigned char)(par[4]>>8)); //set the coordinate of the bottom right corner point, Xend_H
    I2C_Send_Byte((unsigned char)par[4]); //set the coordinate of the bottom right corner point, Xend_L
    I2C_Send_Byte((unsigned char)par[5]); //set the coordinate of the bottom right corner point, Yend
    I2C_Send_Byte((unsigned char)par[6]); //character Color R,you needed
    I2C_Send_Byte((unsigned char)par[7]); //character Color G,you needed
    I2C_Send_Byte((unsigned char)par[8]); //character Color B,you needed
    I2C_Send_Byte((unsigned char)par[9]); //background Color R,you needed
    I2C_Send_Byte((unsigned char)par[10]); //background Color G,you needed
    I2C_Send_Byte((unsigned char)par[11]); //background Color B,you needed
    I2C_Stop();
}
//=====//
```



9. Reliability Test Conditions

No.	Test item	Test condition	Inspection after test
11.1	High temperature storage	80±2°C/120 hours	Note 1,2
11.2	Low temperature storage	-30±2°C/120 hours	
11.3	High temperature operating	70±2°C/120 hours	
11.4	Low temperature operating	-20±2°C/120 hours	
11.5	Temperature cycle	-20±2°C~25°C~70±2°C*10cycles (30min.) (5min.) (30min.)	
11.6	Damp proof test	60°C*90% RH/96 hours	
11.7	Vibration test	Frequency : 10Hz~55Hz~10Hz Amplitude : 1.5mm , X , Y , Z direction for total 3hours (Packing condition)	
11.8	Dropping test	Drop to the ground from 1m height, one time, every side of carton. (Packing condition)	
11.9	ESD test	Voltage : ±800V R : 330Ω C : 150pF Air discharge, 1 time	

Remark :

Note 1: No condensation to be observed.

Note 2: Conducted after 4 hours of storage at 25°C, 0%RH.

10. INSPECTION CRITERION

10.1 Objective

The LCM test criterion are set to formalize LCM quality standards for NEWPANELTECH with reference to those of the customer for inspection, release and acceptance of finished LCM products in order to guarantee the quality of LCM products required by the customer.

10.2. Scope

The criterion is applicable to all the LCM products manufactured by NEWPANELTECH.

10.3. Equipment for Inspection

Electrical tester, electrical testing machines, vernier calipers, microscopes, magnifiers, anti-static wrist straps, finger cots, labels, tri-phase cold and hot shock machine, constant temperature and humidity chamber, backlight table, ovens for high-low temperature experiments, refrigerators, constant voltage power supply (DC), desk Lamps, etc.

10.4. Sampling Plan and Reference Standards

10.4.1 Sampling plan :

Refer to National Standard GB/T 2828.1---2012/ISO2859-1:1999, level II of normal levels :

Major defect: AQL 0.4

Minor defect: AQL 1.0

10.4.2 GB/T 2828.1---2012/ISO2859-1:1999 Sampling check procedure in count

10.4.3 GB/T 18910. Standard for LCM parts

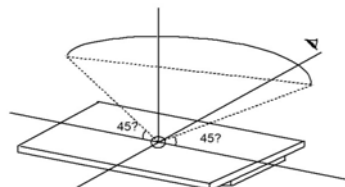
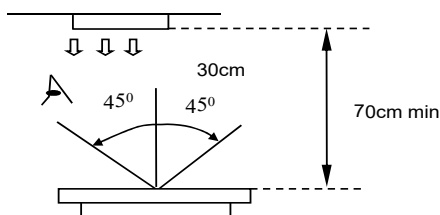
10.4.4 GB/T24213-2008 Basic Environmental Test Procedures for Electrical and Electronic Products

10.4.5 IPC-A-610E Acceptability of Electronic Assemblies

10.5. Inspection Conditions and Inspection Reference

10.5.1 Cosmetic inspection: shall be done normally at $23\pm5^{\circ}\text{C}$ of the ambient temperature and 45~75%RH of relative humidity, under the ambient luminance between 500lux~1000lux and at the distance of 30cm apart between the inspector's eyes and the LCD panel and normally in reflected light. For backlight LCM, cosmetic inspection shall be done under the ambient luminance less than 100lux with the backlight on.

10.5.2 The LCM shall be tested at the angle of 45° left and right and $0-45^{\circ}$ top and bottom as the following picture showing:



10.5.3 Definition of viewing area(VA)

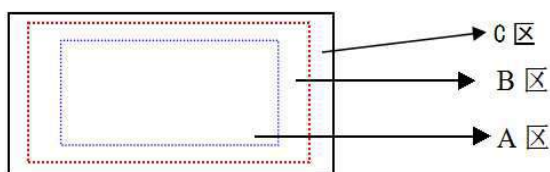
A area : Active area(AA area)

B area : Viewing area(VA area)

C area : Non-viewing area(not viewing after customer assembly)

If there is any appearance viewing defect which do not affect product quality and customer assembly in C area, it's accepted in generally.

The criteria apply to A and B area except chipping and crack.



10.5.4 Inspection with naked eyes(exclusive of the inspection of the physical dimensions of defects carried out with magnifiers)

10.5.5 ND card use method(refer to right conner image) and scope: Multi-bright dot; Mura(Black/Gray pattern uneven); dark line and so on.

10.5.6 Undefined items or other special items, refer to mutual agreement and limited sample.If criterion does not match product specifications/ technical requirement, both should be subject to special inspection criterion agreed by customer.




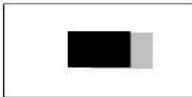

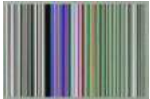

10.6. Defects and Acceptance Standards

10.6.1 Electrical properties test

10.6.1.1 Test voltage(V) : Refer to the instruction of testers and the product specification or drawing and the display content and parameters and display effects shall conform to the product specification and drawing.

10.6.1.2 Current Consumption(I) : Refer to approved product specifications or drawings.

10.6.1.3 Function items(Defect category : MA.)

No.	Defects	Descriptions	Pictures	Inspection method/tools	Defect category
10.6.1.3.1	No display /reaction	shows no picture/display in normal connected situation.		Naked eyes/ testers	MA.
10.6.1.3.2	Missing segment	Shows missing lines in normal display		Naked eyes/ testers	MA.
10.6.1.3.3	Dark line	Only visible on gray pattern, 1 or more vertical/horizontal lines:5%ND,not visible,OK	/	Naked eyes/ testers	MA.
10.6.1.3.4	POL angle defect	Not accepted		Naked eyes/ testers	MA.
10.6.1.3.5	Image retention (sticking)	Chess pattern stays for 30mins and change to 50% gray pattern,disappear time <10s, OK; if time>10s, NG		Naked eyes/ testers	MA.
10.6.1.3.6	Flicker	Refer to limit sample if essential or flicker value<-30dB(measured by CA310A); OK		Naked eyes/ CA310A	MA.
10.6.1.3.7	Display abnormal	Not accepted		Naked eyes/ testers	MA.
10.6.1.3.8	Cross-talk	Refer to limited sample		Naked eyes/ limited sample	MA.
10.6.1.3.9	Display dim/bright	Refer to limited sample	/	Naked eyes/ limited sample	MA.
10.6.1.3.10	Contrast	Refer to limited sample	/	Naked eyes/ limited sample	MA.
10.6.1.3.11	Huge current	Out of spec, not accepted	/	Ammeter	MA.
10.6.1.3.12	TP function defect	Not accepted	/	Naked eyes/ Touch/ test program	MA.

10.6.2 LCD dot/line defect

10.6.2.1 LCD pixel dot defect(defect category : MI.)

Item	Inspection criterion		
Size	S<5"	5"≤S<10"	10"≤S<15"
Color pixel dot defect(RGB dot)	1	2	2
2 connected bright dot	0	1	1
3 connected bright dot or more	0	0	1
Bright dot quantity	1	2	3

Item	Inspection criterion		
Random dark dot quantity	2	3	4
2 connected dark dot	1	1	2
3 connected dark dot or more	0	0	0
Dark dot quantity	3	4	5
Multi-bright dot	ND 3%hidden, OK		

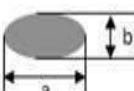
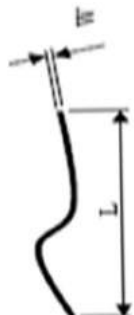
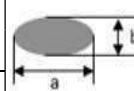
Remark: 2 bright dots distance $DS \geq 15\text{mm}$ 2 dark dots distance $DS \geq 5\text{mm}$

1) Bright dot: Power on LCM and RGB dot in black display

2) Dark dot: Power on LCM and gray or black dot in RGB display

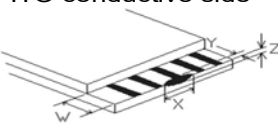
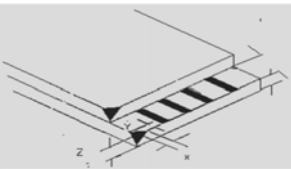
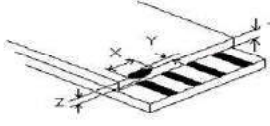

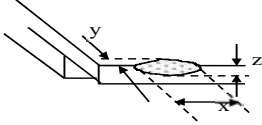
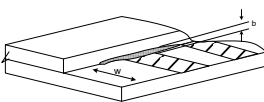

3) Multi-bright dot: Power on LCM and fluorescent tiny dot in black display(only visible in black display)

10.6.2.2 LCD appearance dot defect (defect category : MI.)

No.	Item	Inspection criterion				Picture	Inspection method/tools	
		Size	S<5"	5"≤S<10"	10"≤S<15"			
10.6.2.2.1	Dot defect (black dot, white dot)	D≤0.15	Not count	Not count	D≤0.2mm		Naked eyes /film card /magnifier	
		0.15<D≤0.25	3	3	Not count			
		0.25<D≤0.30	1	2	0.2~0.35mm			
		0.30<D≤0.35	0	1	Q'ty ≤ 4			
		0.35<D≤0.50	0	0	1			
		D>0.5	0	0	0			
		Remark : D≤0.15mm, not count.Multi-dot as bulk is not accepted. Count dot quantity≤ 5 2 round dots or linear dots in 1 cm is judged as multi-dot.						
10.6.2.2.2	Line defect (visible when power on)	Length (mm)	Width (mm)	S<5"	5"≤S<10"	10"≤S<15"		Naked eyes /film card /magnifier
		Not count	W≤0.03	Accepted	Accepted	Accepted		
		L≤5	0.03≤W<0.05	3	3	Not count		
		L≤5	0.05≤W<0.08	0	1	3		
		L≤8	0.05≤W<0.08	0	0	1		
		L>8	W>0.08	0				
		Remark : Invisible when power on,only visible in special angle against light, show as watermark/folding/scratch but can not be touched, no control or refer to keeping sample.						
10.6.2.2.3	Polarizer convex-concave dot defect, polarizer bubble defect	Size(mm)	S<5"	5"≤S<10"	10"≤S<15"		Naked eyes /film card /magnifier	
		D≤0.20	Not count	Not count	Not count			
		0.20<D≤0.5	2	2	3			
		0.50<D≤0.8	0	1				
		0.8<D≤1.5	0	0	1			
		D>1.5mm	0	0	0			



10.6.3 Chipping defect

No.	Item	Accepted criterion(mm)				MA.	MI.
10.6.3.1	ITO conductive side 	X	/	$\leq 1/8L$	/		√
		Y	$Y \leq 1/6W$	$1/6W < Y \leq 1/4W$	$1/4W < Y$		
		Accept	2	2	0		
10.6.3.2	Corner chipping (ITO pins position)	X	/	$\leq 1/6L$	/		√
	Y	$Y \leq 1/2W$	$1/2W < Y \leq W$	$W < Y$			
		Accept	2	1	0		
		Corner chipping occurred in sealed edge position as per 6.3.3; at the same time it should not enter into black border of the frame and the corner chipping effect the electric connection position perform as per 6.3.1.					
10.6.3.3	Chipping in sealed area (outside chipping)  Chipping in sealed area (inside chipping) 	X	/	$\leq 1/8L$	/		√
		Y(outside chipping)	Not enter into sealant	Enter $Y \leq H$	$H < Y$		
		Y(inside chipping)		Enter $Y \leq 1/2H$	$1/2H < Y$		
		Z	$\leq T$	$\leq 1/2T$	/		
		Accept	2	1	0		
		The standards of inner and outer chipping on edge sealing area are same. When the chipping occurred in the opposite of stage, Y as per the chipping on the non-conduction side standard in 6.3.1					
10.6.3.4	Conductive side (back side chipping) 	X	/	$\leq 1/6L$	/		√
		Y	$Y \leq 1/3W$	$1/3W < Y \leq 2/3W$	$2/3W < Y$		
		Accept	2	2	0		
		Chipping into ITO side, refer to 6.3.1					
10.6.3.5	Protruding LCD poor cutting and LCD burrs 	X	/	$\leq 1/8L$	/		√
		Y	$\leq 1/6W$	$1/6W < Y \leq 1/5W$	$1/5W < Y$		
		Z	/	/	/		
		Accept	1	1	1		
		The outside protruding control as per the tolerance of drawing.					
10.6.3.6	Crack 	Not allow to occur cracks without direction; the crack expand to inside is NG, but to outside is OK (confirmed as per the damaged standard)					√
Remark : X means the length of chipping; Y means the width; Z means the thickness; W means the step width of the two glasses; H means the distance from the glass edge to the sealant inner edge; T means glass thickness.							

10.6.4 Backlight components

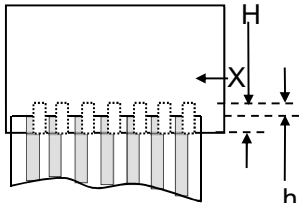
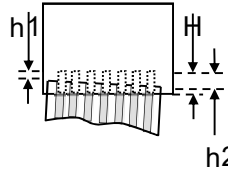
No.	Item	Description	Accepted criterion	MA.	MI.
10.6.4.1	No backlight wrong Color	/	Rejected	√	
10.6.4.2	Color deviation	When powered on, the LCD color differs from its sample and found that the color not conforming to the drawing after testing.	Refer to sample and drawing		√
10.6.4.3	Brightness deviation	When powered on, the LCD brightness differs from its sample and is found after testing not conforming to the drawing; or if it conforms to the drawing but the brightness over $\pm 40\%$ than its typical value.	Refer to sample and drawing		√
10.6.4.4	Uneven brightness	Uneven on the same LCD and out of the specification of the drawing. The no specification evenness= (the max value-the min value)/ mean value< 70%.	Refer to sample and drawing		√
10.6.4.5	Spot/line/ scratch	When power on, it has dirty spot, scratches and so on spot and line defects.	Refer to 6.2.2		√

10.6.5 Metal frame (Metal Bezel)

No.	Item	Description	Accepted criterion	MA.	MI.
10.6.5.1	Material & surface treatment	Metal frame/surface treatment do not conform to the specifications.	Rejected	√	
10.6.5.2	Tab twist Unconformity /Tab not twisted	Wrong twist method or direction and twist tabs are not twisted as required.	Rejected	√	
10.6.5.3	Bezel paint loss	1.Front surface : Paint peel off and scratch to the bottom	Rejected		√
10.6.5.4	Bezel scratch	Dot:D \leq 0.5mm, exceeds 3; Line:L \leq 3.0mm,W \leq 0.05mm exceeds 2;			√
10.6.5.5	Painting peel off, discoloration, dent, and scratch	2.Front dent, air bubble and side with paint peeling off scratch to the bottom Dot: D \leq 1.0mm, exceeds 3; Line:L \leq 3.0mm,W \leq 0.05mm, exceeds 2;			√
10.6.5.6	Burr	Burr(s) on metal bezel is so long as to get into viewing area.	Rejected		√

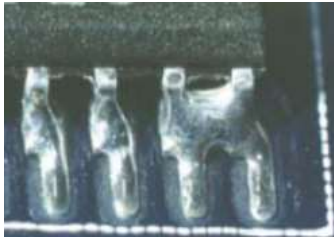



10.6.6 FPC

No.	Item	Description	Accepted criterion	MA.	MI.
10.6.6.1	Model &P/N	Material model & P/N	Keep the same with drawing and technical requirement	√	
10.6.6.2	Dimension/ position	<p>Dimension in drawing spec</p>  <p>Remark: H=ITO pin length f=FPC width W=ITO pin width</p> 	<p>$f \leq 1/3w$, $h \leq 1/3H$, dimension in drawing spec-> OK</p> <p>Conductive material and ITO/PDA connective area must over than 1/2.</p> <p>Entire dimension must be in spec tolerance.</p>		√
10.6.6.3	FPC appearance	Hot pressing material get broken, folding line open; FPC golden finger oxidate, broken ,scratch ,foreign material which cause line short	Broken length<2mm; FPC line is OK- > Accepted Crack and line broken->Rejected		√
10.6.6.4	FPC burr	Burr near FPC edge area	When cover line and burr length $\leq 1.0\text{mm}$ ->Accepted		√
10.6.6.5	FPC falling off	FPC bonding area falling off ; silica gel breaking	Rejected		√
10.6.6.6	Sealant missing ITO line	Sealant is not covered all ITO line	Rejected	√	
10.6.6.7	Missing sealant	No sealant	Rejected	√	
10.6.6.8	Sealant	Sealant height ->product total height	Rejected	√	


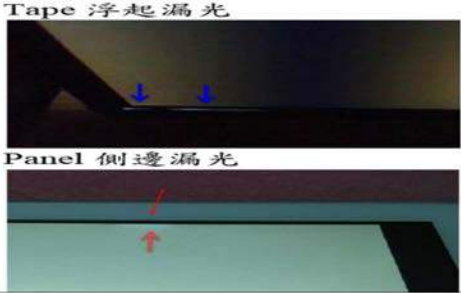


10.6.7 SMT

No.	Item	Description	Accepted criterion	MA.	MI.
10.6.7.1	Soldering bridge	Solder between adjacent pads and components 	Rejected		√
10.6.7.2	Solder ball/splash	Solder ball/tin dross causing short circuit at the solder point. There are active solder ball and splash.	Rejected		√
10.6.7.3	Soldering excursion	Soldering slant > 1/3 soldering pad 	Rejected		√
10.6.7.4	Component wrong attaching	Component on PCB differs with drawing: wrong one, extra one, lack one, opposite polarity	Rejected	√	
		JUMP short circuit on PCB: extra soldering, lack soldering.	Rejected	√	
10.6.7.5	Component falling off	Soldering but component is missing	Rejected	√	
10.6.7.6	Wrong component	Component model/spec differs from product specification	Rejected	√	



10.6.8 General Appearance

No.	Item	Description	Accepted criterion	MA.	MI.
10.6.8.1	Dimension	According to drawing	Accepted	√	
10.6.8.2	Surface stain	Defect mark or label are not removed residual glue, and finger print,etc;	Rejected		√
10.6.8.3	Assembly foreign material	Dot/linear stain after assembly backlight and diffuse film TP assembly foggy stain	Invisible when power on->OK Refer to 6.2.2 dot/line spec		√
10.6.8.4	Mixture	Different model product in the same shipment	Rejected	√	
10.6.8.5	Product mark	Missing, unclear, incorrect, or misplaced part	Rejected		√
10.6.8.6	Component mark	Silk screen mark clear, resistance measured value in spec	Accepted (Refer to customer special requirement)		√
10.6.8.7	Newton's rings	Area<1/6 screen area quantity≤1	Accepted		√
10.6.8.8	Mura	1.In black display ND 3% invisible ->OK; visible->NG 2.Naked eyes inspection RGB display invisible Black display, area<1/4 screen area	Refer to limited sample 		√
10.6.8.9	Light leak	1.LCD edge(near backlight) shadow by LCD lamps irregular illuminate 2.Judge in black/white/gray display (slight leaky is yellowish,greenish, blueish ->NG); 	Refer to limited sample		√
10.6.8.10	Polarizer	1.Polarizer slant.Cover VA and not over LCD edge 2.No unmovable stain or finger print in polarizer VA 3.Bubble/warped but not enter VA	Accepted		√
10.6.8.11	TP defect	1.TP crack 2.TP stain(foggy& unremovable) 3.TP glue overflow to VA	Rejected		√

Remark :

Anything which is not clearly defined in 6.5~6.8 should refer to IPC-A-610E.Consumer Electronics, Non-consumer Electronics refer to I grade and Industrial,Automobile refer to II grade.

10.7 Others

Items not specified in this document or released on compromise should be inspected with reference to mutual agreement and limit samples.



11. HANDLING PRECAUTIONS

11.1 Mounting method

The LCD module consists of two thin glass plates with polarizers which easily be damaged. And since the module is so constructed as to be fixed by utilizing fitting holes in the printed circuit board.

Extreme care should be needed when handling the LCD modules.

11.2 Caution of LCD handling and cleaning

When cleaning the display surface, Use soft cloth with solvent

[recommended below] and wipe lightly :

- Isopropyl alcohol
- Ethyl alcohol

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent :

- Water
- Aromatics

Do not wipe ITO pad area with the dry or hard materials that will damage the ITO patterns

Do not use the following solvent on the pad or prevent it from being contaminated :

- Soldering flux
- Chlorine (Cl) , Sulfur (S)

If goods were sent without being silicon coated on the pad, ITO patterns could be damaged due to the corrosion as time goes on.

If ITO corrosion happens by miss-handling or using some materials such as Chlorine (Cl), Sulfur (S) from customer, Responsibility is on customer.

11.3 Caution against static charge

The LCD module uses C-MOS LSI drivers, so we recommended that you :

Connect any unused input terminal to Vdd or Vss, do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

11.4 Packing

Module employs LCD elements and must be treated as such.

- Avoid intense shock and falls from a height.
- To prevent modules from degradation, do not operate or store them exposed direct to sunshine or high temperature/humidity.

11.5 Caution for operation

• It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage then the limit cause the shorter LCD life.

• An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.

• Response time will be extremely delayed at lower temperature then the operating temperature range and on the other hand at higher temperature LCD's show dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, which will come back in the specified operation temperature.

• If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.

• A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.

• Usage under the maximum operating temperature, 50%Rh or less is required.

• When fixed patterns are displayed for a long time, remnant image is likely to occur.

11.6 Storage

In the case of storing for a long period of time for instance, for years for the purpose or replacement use, the following ways are recommended.

- Storing in an ambient temperature 10°C to 30°C, and in a relative humidity of 45% to 75%. Don't expose to sunlight or fluorescent light.
- Storing in a polyethylene bag with the opening sealed so as not to enter fresh air outside in it. And with no desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light's keeping the storage temperature range.
- Storing with no touch on polarizer surface by anything else.

It is recommended to store them as they have been contained in the inner container at the time of delivery from us.

11.7 Safety

• It is recommendable to crash damaged or unnecessary LCD's into pieces and wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.

• When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water.



12. PRECAUTION FOR USE

12.1 A limit sample should be provided by the both parties on an occasion when the both parties agreed its necessity. Judgment by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.

12.2 On the following occasions, the handing of problem should be decided through discussion and agreement between responsible of the both parties.

- .When a question is arisen in this specification.
- .When a new problem is arisen which is not specified in this specifications.
- .When an inspection specifications change or operating condition change in customer is reported to NEWPANELTECH, and some problem is arisen in this specification due to the change.
- .When a new problem is arisen at the customer's operating set for sample evaluation in the customer site.